SOIL CONSERVATION

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Choice pasture land to the east of Minden and within Nevada soil conservation district No. 7.

CONSERVING KEY AREAS IN SOUTHWESTERN RANGE LANDS

By C. C. SIKES [1]

CONSERVATION values are often difficult to segregate; many times they are so distributed throughout the land-use pattern that at first glance the efforts of conservationists may seem misplaced or out of proportion to the good that is done. This probably is nowhere else as true as in the conservation programs of the West, and particularly in Nevada. Nevada contains over 70 million acres of land, of which 8 million are privately owned, with half of all the privately owned lands included within grants to railroads. Of the land in private ownership, less than 700,000 acres are irrigated, and it has been reported that these irrigated acres, amounting to less than 1 percent of the State's total, provide feed to livestock 50 percent of the time. These fertile irrigated acres are scattered in varying sized groups throughout the State.

These small areas usually consist of valleys where pasture, meadow hay, or irrigated alfalfa is raised to carry the livestock through the winter period when

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most of the better range is covered with snow—the word "Nevada" is from the Spanish and means "snow-covered." The "oases," as they are termed, are actually the key spots in this vast grazing State, because the total production of livestock is governed to a large degree by their capacity, with their alfalfa fields, hay, and native grass pastures, to produce the necessary supplemental feed for winter use. They are, therefore, of great importance to the livestock industry.

For the protection of these small fertile areas a conservation program is being worked out jointly by the Soil Conservation Service, the Indian Service, and the Extension Service, on a somewhat typical area of 289,500 acres, comprising the Duck Valley Indian Reservation, half of which is in Idaho and half in Nevada. Owyhee, the principal community, including most of the 140 families on the reservation, lies in the reservation's valley, which is approximately 6 miles wide and 20 miles long. Within the boundary of this valley are the irrigated lands. The surrounding bench lands furnish typical desert-range grazing and are covered with sagebrush, annual and perennial grasses. At the higher elevations there are dense stands of perennial grasses which provide excellent summer feed.

In the past it has been customary for the Indians to lease the grazing rights on their land to outside stockmen, and the returns from these leases, plus the part of their support contributed by the Federal Government, formed their principal means of livelihood. As might be expected under such conditions, individual initiative was not the rule.

The Indian Service is now encouraging these people to become more self-supporting and to raise stock themselves instead of leasing their lands. This change from lessors to operators means changes in the attitude of the Indians as well as in methods of operating the land, and many practices designed to conserve the range and pasture lands already have been started by the Indian Service. Stock-watering facilities have been increased through the installation of windmills and stock ponds. Additional fence has been built, and portions of the bottomlands have been reseeded for forage increase. A forestry program has been initiated to ensure a dependable supply of fence posts and firewood.

The presence or lack of irrigation water in the West is always a determining factor in land use. Only 17,000 out of a total of nearly 300,000 acres in the reservation had been developed for the production of irrigated meadow, pasture, and hay crops, and hence it was apparent that there was great need for more irrigation water. This condition has been alleviated by the completion of Wild Horse Dam, a project of the Bureau of Irrigation of the Indian Service. The dam will supply sufficient water for the irrigation of approximately 26,000 acres. Miles of irrigation canals with their network of laterals now carry the water from the dam to the once arid lands.

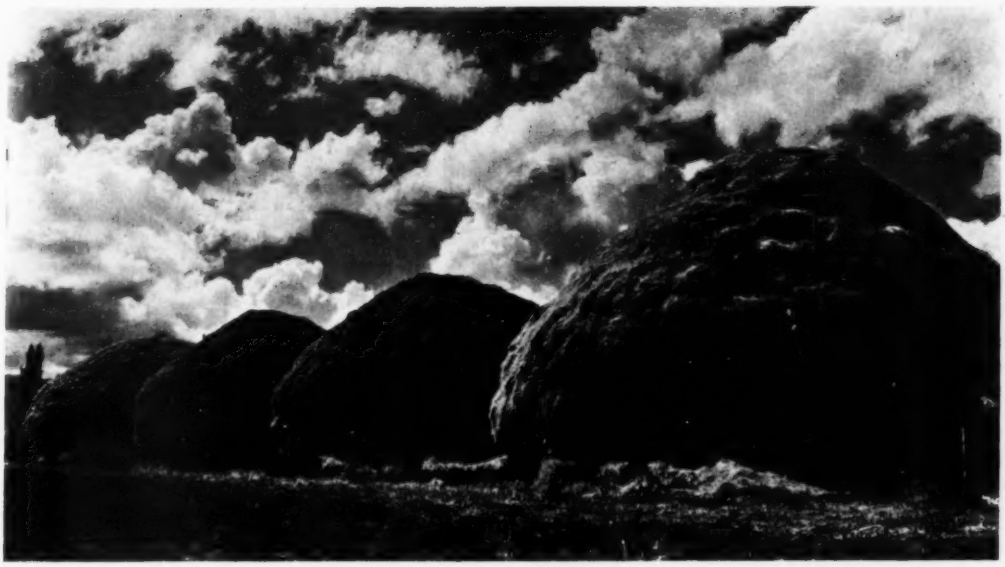
These newly irrigated lands presented many conservation problems. Besides the determining of crops required by the reservation, it was necessary that careful consideration be given to the correct placement of forage species for each site and circumstance encountered. A study of the reservation and its conservation problems emphasized the need for many adjustments in land use as well as for improvement in soil-management and cropping practices. The range in general was found to be in good condition, although certain areas, because of their accessibility, had been over-utilized. The over-utilization was the result in part of the lack of divisional fences and watering facilities.

Although the range lands were capable of supporting more stock than was being carried at the time the survey was made, the observations indicated a pressing need for additional green finishing feed as well as for winter hay. Because of shortage of supplemental feed, stock had been turned out on the range too early in the spring and kept on the range too late in the fall.

Because of the high water table on certain bottomlands, moisture conditions were found to be unfavorable for maximum crop production, and, aggravating this condition, was the practice on some of these lands of applying irrigation water for long periods. This over-irrigation discouraged the more valuable forage species, and was favorable to the intrusion of undesirable weeds.

Many of the alfalfa fields, although located on adaptable sites, had relatively thin stands, and cheatgrass had intruded, lowering both the production and quality of the hay. Also, in some instances, crops were being planted on sites where soil and moisture conditions were not favorable for their best growth.

The plan of conservation for this reservation includes numerous practices, all of which contribute toward a sound livestock enterprise and permanent agriculture. In putting this plan into operation, the Indian Service supplies labor, equipment, and a proportionate share of materials. The contribution of the Soil Conservation Service is largely one of technical assistance and supervision, although certain materials not available from the Indian Service will be furnished. On the range, boundary fences will be completed and the existing fences repaired or replaced. Division



Stacks of hay for supplemental feed.

fences will be constructed, permitting the proper distribution of stock in accordance with range conditions. Springs and wells will be developed and stock ponds and tanks started by the Indian Service will be completed and others constructed. The ponds will be of value to wildlife as well as livestock.

The agronomic plan for these 26,000 acres of irrigable lands, which form the key to the use of nearly 300,000 acres of surrounding range, has been designed to fit into the broad conservation program. Seeding and reseeding to pasture and permanent hay will proceed at the rate of about 2,000 acres a year until the point is reached where further expansion is undesirable or unnecessary. Reseeding on the reservation by the Indian Service has demonstrated that with proper care and management the forage production on the present croplands may be increased to a considerable extent.

The various aspects of the agronomic plan are given priority in respect to economic needs, availability of funds, etc. The most productive lands will receive first consideration. As the program develops, thousands of arid acres covered with sagebrush, but subject to irrigation, will be cleared. Beginning in the spring of 1940, about 1,400 acres of wet bottomland will be renovated. Reseeding will be necessary, involving the use of moisture-tolerant species that will provide hay and pasture. Specified for this use are redtop (*Agrostis alba*), meadow fescue (*Festuca elatior*), alsike clover (*Trifolium hybridum*), timothy (*Phleum pratense*), and Reed's canary grass (*Phalaris arundinacea*). A mixture composed of redtop, timothy, and alsike clover will constitute the largest plantings. Approved agronomic and soil-management practices will be applied, and judicious use of irrigation water will do much toward maintaining the desired vegetative composition. Water saved in this manner can be effectively utilized on the many arid acres. Drainage ditches will be installed in strategic areas by the Indian Service.

In thin stands of alfalfa where cheatgrass has intruded, the program provides for the interseeding of forage grasses to discourage growth of cheatgrass and at the same time improve the production and quality of hay. Since the hay produced is not sold outside of the reservation, an alfalfa-grass mixture is quite acceptable to the Indians and provides a well-balanced forage for stock. The alfalfa fields are pastured during the fall and, with grass in the composition, the danger of bloat is largely eliminated. About 460 acres of alfalfa will be treated in this manner, using interseeding of smooth brome (*Bromus inermis*), orchard grass (*Dactylis glomerata*), and meadow fescue (*Festuca elatior*) in mixture.

At the time of survey, about 70 acres were devoted to the production of cereal crops. However, inasmuch as there is an urgent need for greater production of both cereal hay and grain, provision has been made for an increase of these crops by growing them in rotation

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SOIL CONSERVATION IN TUNG ORCHARDS

By GEORGE N. SPARROW [1]

A DISMAL future seemed predestined for five small tung trees that found their home in the soil near Tallahassee, Fla., on November 15, 1906. Orphans in a strange land far removed from their parentage in distant China, their culture, wants, and needs were unknown to their friendly but perhaps none-too-hopeful guardians. Four of the trees were unable to cope with the strange circumstances of life in a foreign land. Adversities of weather and soil—and perhaps culture—brought an end to their existence.

The fifth tree survived and reached maturity. In 1913 its nuts produced 2⅞ gallons of tung oil, the first such oil to be produced in the United States. That tree still stands—symbolic of the beginning of a new American industry, the future of which is still clouded with skepticism on one hand and with over enthusiasm and get-rich-quick schemes on the other.[2] A middle road of cautious and sane entry into the business—and a number of growers seem to be following that road—is indicated as the proper route to follow, when guided by planned research, to eventual success.

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[2] Two other trees living today were also a part of this original lot of trees. One of them stands at Marlow, Baldwin County, Ala., having been planted by the late Ambrose Bardeau. The other was planted by Carl Purdy on his ranch at Ukiah Calif.—*Editor.*

In China, the native habitat of the tung tree (*Aleurites fordii*), little information is recorded of the culture and requirements of the tree. It is reported that tung trees in that country bear a small crop the third year after planting, with increasing yields the fourth, fifth, and sixth years. According to a report on tung culture in West Central China by H. Liu, of the Chemical Research Laboratory, the average maximum useful life of the tung tree is about 20 years. After that age the tung tree ceases to bear fruit, as a result of erosion and exhaustion of fertility in the soil. Under the most favorable natural conditions a tung tree may live over 50 years, but it is no longer productive at that age.

It is probable that the first tung seeds to produce trees in America were imported in 1905 when the Plant Introduction Garden of the United States Department of Agriculture at Chico, Calif., received nuts from the Consul General at Hankow, China. Five 1-year-old seedlings were sent from California to Florida in 1906. In 1911 the first bushel of unshelled nuts or seeds was produced near Tallahassee, Fla. In 1913 the first American-produced tung oil was extracted. By 1915 tung trees had been planted on 40 acres of land near Tallahassee. That planting met

A mature tung orchard.

with such adverse weather conditions that the owner practically abandoned it. About 1925 the orchard was partially rejuvenated by the application of fertilizer and the yield increased. Commercial plantings of tung trees began about 1923. The establishment of new sources of tung oil appeared necessary, as is indicated in the following quotation from the North China Standard, published at Peking, November 14, 1923: "Unless political and commercial stability soon return to Szechwan, American varnish manufacturers may be compelled to seek another source for their raw products and may even have to change their processes in order to use other products." Recent historic events indicate that the situation, instead of improving, has probably become much worse in war-ravaged China. So, with typically American expedition, capital investment in the tung tree in the United States becomes larger each year. According to reliable estimates, approximately 175,000 acres have already been planted to tung trees. Some authorities contend that from 25 to 50 percent of the acreage now planted will never be productive, because of unfavorable sites and soils.

There is a definite demand for tung oil as a raw material in American manufacture. It is used in the production of varnish, enamel paint, flat wall paint, paint driers, and, with rosin, in waterproof varnish. It is used for waterproofing and with aluminum oxide is made into aluminum tungate for both fireproofing and waterproofing. The electrical industry employs tung oil in insulating compounds and the automobile industry in the making of brake lining and of undercoats in body finishes. Many other uses are also being made of the oil. In 1937 importations of tung oil from China amounted to 175,000,000 pounds, representing a foreign expenditure of $15,000,000 of American capital. Present American production, however, is small compared with the amount used, approximately 4,000,000 pounds of tung oil having been produced in this country in the high-production year of 1938.

Potentialities of the new industry are therefore considered great in the light of present consumption in contrast to present American production. It has not yet been demonstrated, however, that American growers can produce tung oil at a profit in competition with tung oil imported from China and with the other oils used for the same or similar purposes. Prospective growers of tung oil have been warned against blind and promiscuous entry into the business. A considerable number of plantings have already been abandoned because the growers knew too little about

Tung trees grow fast. This one was seeded eight months before the picture was made.

the tree and its requirements. In the United States the tung tree cannot be planted and left alone to mature and produce. Results from such treatment have been very disappointing. Like other orchard plants, the tung tree demands certain requisites of soil, climate, fertility, and general culture.

Much research and experimentation in tung-oil production is needed for proper orientation of the business. Valuable information has already been obtained, while the industry is yet in the formative stage. During the years after the introduction of the tung tree in Florida, experiments were conducted at the Florida Experiment Station at Gainesville. The results from those experiments have already saved orchards seemingly destined for abandonment. One striking example of the experimental work was the discovery of zinc as a

requirement of tung trees and the development of corrective procedures to supply deficiencies. The value of research to the industry has been proved.

Federal appropriations have been made for experimental work with tung oil on a wider scale, and work by the Bureau of Plant Industry and the Bureau of Agricultural Chemistry and Engineering is under way. Agronomic research will involve experimentation in varieties, planting, cultivation, fertilizers, harvesting, breeding, methods of propagation, and so on. Other research will embody a study of the harvested fruit and nuts as to content, characteristics, and production of the oil. A study of uses and byproducts will also be made. All of the research is to be closely correlated.

The Soil Conservation Service has had an opportunity to work with growers in Florida in the establishment of orchards as a part of the demonstration phase of the Service program. A problem of soil conservation and of orchard planning along conservation lines prior to planting confronts growers in certain localities. On and adjacent to the Soil Conservation Service demonstration project near Monticello, Fla., a 2,000-acre orchard of tung trees has been planned and planted toward the end of conserving the soil as well as producing tung oil.

American growers of tung trees are expecting a much longer productive life from the tree than is reported from China. There seems to be little indication that fertilized orchards reach a peak of production the sixth year only to decline in production thereafter. Instead, the orchard is considered at that period of its life as just becoming a paying proposition and as entering into the prime of its existence as far as production is concerned. Coordinated effort of growers and agricultural agencies, however, is already determining certain peculiarities of the tree. Doubtless, much information will be forthcoming.

American progress is marked by the improvement of industry and agriculture. New industries have profited by the shortcomings of older industries and the older industries which have withstood the test of time have profited by correcting their own mistakes. "Field observations indicate that some of the most serious erosion in the country occurs in the peach orchards in the South and East and in some of the square-planted, irrigated orchards of the West." [3] With the present knowledge of soil-conservation methods it would be foolhardy for the exponents of the tung-oil industry not to take full cognizance of the experience of other orchardists. The adaptation of modern methods of soil conservation and orchard management is indicated as vital in the insurance of a permanent tung-oil industry.

It has been rather definitely determined that the tung tree requires an inherently productive soil. Plantings have been made, and are probably continuing to be made, on deep, sandy soils. Economic limitations apparently will not permit the application of nutrients into the poorer soils in sufficient quantity to supply the required fertility. Orchards that show promise of continued productivity or of soon coming into economical production have, for the most part, been planted on better soils. Tung trees appear better adapted to soils having a clay subsoil than to any other type of soil.

The tung tree also requires a well-drained soil. That requirement definitely limits the location of satisfactory orchards to land situated sufficiently above natural drainages—surface or underground—to ensure proper drainage. The combining of the requirements of productive soil and good drainage will result in the location of many plantings on undulating topography which is subject to erosion.

The tung tree is a deciduous plant. In tropical climates it sheds its leaves three or four times each year with very little fruiting. This indicates, therefore, that it is not a tropical plant and must experience cool winter temperatures for a proper rest period. However, fruiting is seriously affected or completely prevented if the bloom is killed by frost. Some wood damage by cold has been observed in young trees in the spring when temperatures have suddenly dropped. Injury from low temperatures depends on the physiological condition of the trees at the time, and the degree of cold experienced. There is a northern limit to the establishment of tung trees. The Gulf Coast States probably offer the most promising locations for the tung-oil industry in the United States. According to reports from China the tung tree is adapted best to hilly country where the altitude is not greater than 2,500 feet. Faced with the late frost hazard which exists even in the Gulf Coast States, many planters are establishing their orchards on areas of sufficient slope to provide some protection from frost. The locations of plantings on such terrain present potential erosion problems.

Many growers hold to the idea that the rectangular or square planting of orchards is the most satisfactory, regardless of the slope of the land. Ease of cultivation and the adaptability to cross-cultivation are the logical bases for establishing such plantings. The contention

[3] From the article, Orchard Conference, by C. L. Hamilton, Soil Conservation, June 1937.

Aerial view of a seed-planting of tung trees in the Soil Conservation Service demonstration project near Monticello, Fla.

of the exponents of that type of planting is that adequate protection from erosion will be obtained by the use of annual and perennial cover crops. Other growers—particularly those who have located plantings in soil which is definitely erodible under clean-cultivated, row-crop culture—contend that contour plantings of tung trees with channel-type terraces for the systematic control of run-off water are necessary for the conservation of the soil and for the maintenance of soil fertility. Cultivation of such plantings will, of course, be along the contour rows of trees. The latter type of orchard arrangement is considered much better from a soil-conservation standpoint. Its satisfactory adaptation, however, is dependent upon the peculiarities and characteristics of the tung tree.

Numbers of problems have arisen in regard to the arrangement of contour plantations. The usual spacing of tung trees in orchards varies from 25 by 25 feet to 30 by 30 feet. Contour plantings have been made in rows spaced 30 feet apart with tree spacing 20 feet within the row, but it is the opinion of horticulturists that it will be necessary to remove some trees later, or increase the spacing. Careful attention should be given to get proper location of trees to be retained. When normal terrace spacing is used the horizontal interval between terraces varies to such an extent as to cause considerable loss of usable land. Such a loss is unavoidable as long as tree spacing is kept constant and as long as terrace spacing must follow some empirical rule. Varying the vertical spacing of terraces from accepted standards, within limits, to secure more economical horizontal spacing of the terraces has been used rather generally in one orchard. The practice is considered sound for several reasons. Consistent cultivation of tree rows will inevitably build a ridge along each row. The water-retaining capacity of each row, and the filtration of run-off and the water-detention furnished by cover crops between rows should normally reduce the expected burden on each terrace.

The arrangement of tree rows adjacent to terraces has been a matter of some contention. The normal arrangement has been that of establishing rows parallel to terraces and placing the short rows near the midpoint of the terrace interval. With the placement of one tree row practically on the crest of each terrace there would be sufficient distance between that row and the next row up the hill from the terrace to pro-

vide for satisfactory maintenance of the terrace. One grower contended, however, that such an arrangement was dangerous because the plowing required for terrace maintenance might be detrimental to the trees on the terrace. Cultivation of the tung tree must be shallow in order not to destroy the myriad feeder roots that develop very close to the surface of the soil. Faced with that danger, the grower considered it wiser to place his terraces approximately halfway between tree rows in order that each tree row in his grove could receive like cultivation. Further knowledge of the tree and its cultural requirements may determine whether the grower was unduly alarmed or not.

Of importance in terracing and contour planting an orchard of tung trees is the matter of field roads. In large orchards heavy cultivating equipment and large transportation units will be employed. Loads of tung fruit must be hauled at harvest from the orchard to expression plants or warehouses. Access must therefore be provided to each terrace interval and each tree row without damage to the water-disposal system and with efficient arrangement for vehicular transportation.

In contour plantations the planting of cover crops—leguminous or nonleguminous, annual or perennial—affords a pattern similar to that of strip cropping and with the same ultimate benefit as strip cropping, except that the strips will not vary as to location. Leguminous summer cover crops of *Crotalaria spectabilis*, *Crotalaria intermedia*, *Crotalaria striata*, and cowpeas are proving satisfactory in young orchards but may not prove satisfactory in older orchards unless the trees are widely spaced. Austrian winter peas, vetch, and lupines are proposed for leguminous cover during the winter months. Cultivated grasses and native vegetation are proposed for summer nonleguminous cover, while oats are expected to be grown during the winter. Strips of kudzu are being planted on the most erodible soils and steeper slopes to provide perennial cover and hay. Kudzu is also to be utilized for water-disposal areas and for meadow strips for water disposal.

The use of cover crops is, of course, an excellent practice insofar as conservation of the soil is concerned. Leguminous cover crops are also being tried in tung plantations to determine the effectiveness of this method of improving crop production. Results indicate that the practice is sound.

A number of schools of thought have arisen in regard to tung tree culture. Exponents of each are investing capital along the lines of their convictions. Careful seed selection from trees known to be good bearers generally is considered wise. From that point on, opinions differ. Some growers contend that earlier satisfactory production is obtained by orchard plantings of the seed. Others contend that seedling trees should be produced in the nursery and transplanted in the orchards as one-year-old trees. Considerable interest is being manifested in asexual methods of propagation, such as budding and grafting.

A supplemental industry for tung growers is that of cattle production. Some growers expect to have their cattle range the orchard and thus to obtain extra benefits from palatable cover crops. Such a practice is not generally recommended in young orchards because of the damage to the trees by cattle promiscuously trampling and breaking them. Extra feed in the form of hay and grain can be produced in water-disposal areas and in strips between tree rows but undoubtedly the latter would reduce tree growth and also the nut crop. Complete planning of the farm can usually provide improved pastures in the lowlands which are unsuited for the growth of tung trees.

Bibliography

1. Research on Tung Oil, an address by Dr. Henry G. Knight, Chief, Bureau of Chemistry and Soils, United States Department of Agriculture. Released March 28, 1939.
2. The Tung-Oil Tree, by Wilmon Newell, Harold Mowry, and R. M. Barnette; revised by A. F. Camp and R. D. Dickey, Bulletin No. 280, Agricultural Experiment Station, University of Florida. June 1935.
3. A Preliminary Report on Frenching of Tung Trees, by Walter Reuther and R. D. Dickey. Bulletin No. 318, Agricultural Experiment Station, University of Florida. December 1937.
4. A Preliminary Report on Zinc Sulphate as a Corrective for Bronzing of Tung Trees, by Harold Mowry and A. F. Camp. Bulletin No. 273, Agricultural Experiment Station, University of Florida. December 1934.
5. Tung Oil Industry in Florida (Revised), by Federal Writers' Project of Florida under W. T. Martin, associate editor, New Series No. 11, Department of Agriculture, State of Florida.

STATUS OF DISTRICTS

In August 1937, 2½ years ago, the first soil conservation district was formed by farmers in Anson and Union Counties, N. C. Today, there are 234 such districts, covering nearly 128 million acres of land, in 26 States. Over a million farmers are cooperating with the districts in fighting erosion. The United States Department of Agriculture is at present cooperating with 171 districts, embracing 97 million acres. The Soil Conservation Service is providing the technical assistance for drawing up farm plans and the C. C. C. camp labor where it is available.

ECONOMIC ADVANTAGES AND LIMITATIONS OF SOIL CONSERVATION ON ILLINOIS FARMS

By E. L. SAUER [1]

SIGNIFICANT results are being obtained from a cooperative study in Illinois to examine the economic effects of a soil conservation program, and to ascertain and analyze factors of good farming under soil-conserving conditions.[2] Detailed farm records are being kept on farms cooperating with the Soil Conservation Service in its demonstration program and also on neighboring farms that are following the usual systems of farming.

During the 4 years, 1935 to 1938, comparative economic studies have been carried on in the three Soil Conservation Service project areas in Illinois (Le Roy, Edwardsville, and Freeport) and in two Soil Conservation Service camp work areas (Marion and Aledo). In the Le Roy area, where farm records have been kept since 1935, farms cooperating with the Service program were matched, insofar as possible, with neighboring noncooperating farms on the bases of number of acres, soil ratings, proportions of land tillable, and land valuations.

While normally 3 to 5 or more years are required to establish completely a soil-conserving system of farming, account records covering in all cases 1 to 4 years after the program was initiated already show striking results in an economic comparison of cooperators and noncooperators. By 1938, cooperating farms in the Le Roy area had improved materially over those employing the usual system of cultivation (see table 1).

TABLE 1.—*Trends in land use, cooperating and noncooperating farms*

Year	Proportion of tillable land in grain crops		Proportion of tillable land in hay and pasture		Proportion of tillable land in soil-building legumes	
	Cooperators	Noncooperators	Cooperators	Noncooperators	Cooperators	Noncooperators
1935	77.8	86.5	22.2	13.5	8.8	2.7
1936	73.6	88.2	26.4	11.8	15.9	4.8
1937	71.7	91.4	28.3	8.6	13.8	3.1
1938	77.0	83.5	23.0	16.5	16.2	8.9

Thirty-nine cooperating farms, following a planned program of soil-erosion control, were developing during this time a much sounder land-use system from the standpoint of a permanent agriculture than that of 33 neighboring farms not following a planned program of soil-erosion control. These cooperating farms grew less corn, oats, wheat, and soybeans, acre for acre, than their neighbors, and still had higher incomes. In 1938, the conservation farmers had in soil-building legumes almost twice as much tillable land as noncooperators. Upward trends in hay and pasture and in soil-building legumes for noncooperators in 1938 were due to increased participation in the A. A. A. program and the adoption of some of the practices observed on farms of Soil Conservation Service cooperators.

Improved rotations (including the use of green-manure crops), applications of limestone, phosphate, and fertilizer as well as a larger amount of animal manure, and soil-conserving practices such as contour farming, strip cropping, terracing, and use of buffer strips and grass waterways, were reflected in substantial improvement in crop yields on cooperating farms as compared with noncooperating farms (table 2).

TABLE 2.—*Trends in crop yields on cooperating and noncooperating farms*

Year	Corn, bushels per acre		Oats, bushels per acre		Soybeans, bushels per acre	
	Cooperators	Noncooperators	Cooperators	Noncooperators	Cooperators	Noncooperators
1935	49.8	47.2	32.5	29.8	16.8	19.4
1936	29.5	27.7	28.2	25.7	18.4	18.5
1937	55.6	48.8	51.5	48.3	22.2	19.6
1938	54.6	48.4	35.5	31.5	28.2	21.9

These crop yields on conservation farms represent the improvement attained while the planned program is still in its early stages. It is expected that in the future the long-time results of following a good system of land use will be even more significant than results secured in the first 4 years of this study.

By 1938, livestock was playing a relatively more important part than in 1935 in the higher earnings obtained on cooperating farms. As compared with noncooperators, these farms had larger investments in livestock, fed more feed, and were more efficient in feeding operations. In 1938, cooperating farms fed feed valued at $1,169 (exclusive of pasture) to productive livestock as compared with $692 for farms following the old system. In 1935, cooperators fed

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[2] The Department of Agricultural Economics of the University of Illinois, the Soil Conservation Service, and the Bureau of Agricultural Economics of the U. S. Department of Agriculture are the cooperating parties.

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EDITOR'S NOTE.—Mr. Sauer's article is based on a broadcast entitled "Soil Erosion Control and Farm Earnings" presented over Station WILL on Friday, June 30, 1939, by Prof. M. L. Mosher, of the Department of Agricultural Economics, University of Illinois, and the author.

feed valued at $1,007, and noncooperators $772. With more roughage produced as a result of the conservation program, operators of conservation farms naturally increased the number of roughage-consuming livestock in order to utilize forage crops most profitably. Good soil-building legumes used in hay and pasture mixtures on cooperating farms resulted in higher quality roughages and hence in more effective livestock gains from the point of view of efficient farming.

The data in table 3 indicate a close relationship between legumes, livestock, and crop yields. Sufficient legumes in the cropping system, combined with enough livestock to make economic use of the legumes, proved profitable on farms included in a long-time farm account study in Illinois.[3] The data show that at the start of the 10-year period, the farms with the most legumes and livestock had an average advantage of 2.9 bushels of corn per acre, and at the end of the period they had an average advantage of 9.4 bushels per acre.

TABLE 3.—*Percent of tillable land in soil-building legumes, amount of livestock fed, and corn yields on 57 central Illinois farms, 1925–34*

Item	20 farms with most legumes and livestock	20 farms with least legumes and livestock
Percent of tillable land in soil-building legumes	21.4	11.1
Feed fed per acre to livestock	$13.55	$6.88
Corn yields per acre:		
Average, 1925, 1926, and 1927	51.9	49.0
Average, 1932, 1933, and 1934	49.9	40.5
Average, 1925–34	49.5	45.0

Average costs for man labor, horse labor, and machinery per crop-acre, were somewhat higher on cooperating farms during 2 of the first 3 years of the study. By 1938, however, there was no significant difference in these items on the two groups of farms.[4] Total operating expenses per acre in that year were $10.83 on cooperating farms and $10.84 on noncooperating farms. These operating expenses include the annual charge for limestone and phosphate applied in 1938 and in previous years, as well as all other operating expenses such as those for machinery, equipment, labor, seeds, fencing, building repairs, taxes, and miscellaneous items.

Based on the records, it appears that after initial improvement is made, soil conservation practices such as strip cropping, contour farming, farming with terraces, the establishment and maintenance of grassed waterways, and the adoption and following of a good system of land use have not increased total farm operating expenses. Costs of materials furnished by the Soil Conservation Service, such as limestone, fertilizer, seeds, and fencing and charges for the use of terracing machinery, C. C. C. labor, and Service technicians' time, have not been included in the farm operating expenses on the Soil Conservation Service cooperators' farms as shown in table 4. These costs, if spread over a period of 3 to 5 years, would be relatively low compared to the regular operating expenses of the farm. The data secured in this study as well as data from long-time farm record studies in Illinois indicate that if higher costs occur in the years when the program is being inaugurated, these costs are likely to be more than offset by increased returns in later years as the soil improvement program becomes effective and as losses from soil erosion are brought under control.

The real test of the feasibility of conservation is a determination of net returns in dollars and cents, and here again the cooperating farms have shown better results. They had larger gross incomes and their expenses were no higher; hence their net incomes were larger than those of noncooperating farms as may be seen in table 4.

TABLE 4.—*Gross income, total expenses, and net income on cooperating and noncooperating farms*

Year	Gross income per acre		Total expenses per acre		Net income per acre	
	Cooperators	Non cooperators	Cooperators*	Noncooperators	Cooperators	Noncooperators
1935	$14.86	$13.91	$8.57	$9.11	$6.29	$4.80
1936	21.35	19.67	9.77	9.73	11.78	9.94
1937	20.44	16.81	10.54	10.27	9.90	6.54
1938	18.40	15.87	10.83	10.84	7.57	5.03

*Contributions of Soil Conservation Service not included.

Based on the average-sized farm in this study (193 acres), cooperating farms in 1935, the first year the program was underway, had an advantage in net income of $288 per farm; in 1936, $355 per farm; in 1937, $648 per farm; and in 1938, $490 per farm. While these data

[3] Farm Practices and Their Effects on Farm Earnings. By M. L. Mosher and H. C. M. Case. University of Illinois. Agricultural Experiment Station Bulletin 444. 1938.

[4] Average costs per crop-acre for man labor, horse labor, and machinery for the 4 years 1935–38 were as follows: cooperators, $8.74, $10.01, $10.92, $10.44; noncooperators, $8.88, $8.79, $9.45, and $10.39.

show that cooperating conservation farms had somewhat higher net returns when the conservation program was inaugurated, they also show that the spread in earning power between conservation and nonconservation farms increased during the 4-year period. The well-planned conservation program, embodying the best use for each acre of the farm, paid dividends for the conservation farmers.

The smaller sample of data available on other Soil Conservation Service demonstration areas under study shows results similar to those obtained in the Le Roy area. In fact, the farm record studies made to date indicate that a planned program of soil conservation and erosion control not only makes possible higher farm incomes, but also provides for maintenance and improvement of soil resources and for farm improvements, thus adding to the capital assets of farms.

The higher incomes possible under the individual farm programs are, of course, predicated upon prices for farm products being maintained at fair levels.

The available economic data provide a strong argument in favor of conservation farming under Illinois conditions; in fact, they indicate that a farmer cannot afford to disregard such a program. Paradoxically, those farmers who have been in most urgent need of soil-conserving measures for the most part could not afford to adopt such a program. The chief reason for this is that current income has not been large enough to enable them to meet current operating and living expenses (including the payment of interest and indebtedness) and at the same time provide for the initiation of a soil conservation program which of necessity requires long-term planning. An outlay of cash, a source of credit, or government aid is usually necessary to enable farmers to take the initial step in a planned program of soil conservation and erosion control. On the majority of those farms that need to adopt a conservation program, the principal help available to farmers is that provided by the A. A. A. program, with payments for specific soil-building practices. Government aid through the Soil Conservation Service is tapering off as demonstrational phases of the program are drawn to a close, and at best this aid is limited to the project and demonstration work areas and soil-conservation districts.

In all the Soil Conservation Service demonstration areas in Illinois where farm records were secured, the low-income farms (in most instances farms that were badly eroded and in a low state of productivity) did not have large enough incomes to permit that much if anything be spent in the inauguration and adoption of a conservation system of farming. This is illustrated by the "cash farm balance" (cash available for farm family living expenses, interest payments, debt retirement, etc.) on the low-earning one-third of the farm account keepers' farms for 1937, the most representative of the 4 years, 1935–38. This balance averaged per farm for the several areas as follows: Le Roy area, $868; Edwardsville area, $764; Freeport area, $1,037; Aledo area, $272; and Marion area, $43. In connection with these data, it should be realized that farm account keepers represent better-than-average farmers in their communities. Considering the heavy indebtedness on many of these farms, together with the fact that a large proportion are tenant operated and that this cash balance must be divided between tenant and owner, it can readily be seen that limited available cash is a serious deterrent to the individual farmer's inauguration of a program of soil conservation and erosion control.

The farm record studies have demonstrated the economic advantages of a planned program of soil conservation. They have also pointed out the fact that in many instances such a program is not economically possible since full benefits may not be realized for a number of years.

A NOTE ON KUDZU

In less than a decade kudzu, introduced from Japan some 50 years ago and commonly called a "porch vine," has been transformed into an important field crop in the Southeast. Since the beginning of erosion-control projects, more than 40,000 acres of eroded land have been planted to this once ornamental plant.

Kudzu is especially adapted to Southeastern soil and climatic conditions and is not seriously affected by droughts. It will not grow well, however, on poorly drained areas of acid soils or on low marshy lands. The plant is a deciduous, viney legume which grows rapidly during spring and summer months. Kudzu restores fertility to the soil by adding nitrogen and organic matter and it maintains a stand over long periods without yearly soil preparation and planting. It grows vigorously on eroded land after it is well established and with a dense ground cover kudzu protects the soil against beating rains. Not only is kudzu especially suited to reclaim badly eroded slopes in cultivated fields, but it also produces a palatable hay and forage of excellent quality; its feeding value is as high as that of alfalfa and produces larger yields than most annual plants grown for hay. Kudzu can easily be eradicated, thus eliminating the danger of becoming a pest.

STORY OF AN OHIO FARM

COSMOS D. BLUBAUGH worked for years to save enough money to buy an eroding, hill-land farm in his native Knox County, Ohio. His early struggles with erosion and his eventual triumph—his farm today is ranked as an outstanding example in soil conservation—are told here by Mr. Blubaugh.

"We bought this hill farm in 1924. Men who enjoy the feel of earth under their feet will know why I wanted to farm. It took us more than 10 years to learn that we were not treating our land right. We watched heavy rains roll down over our plowed fields, taking off our lime and phosphate and the manure we had applied to clinch the deal for a set of clover. I had paid $40 an acre, and I was losing the most valuable part of my investment—the soil.

"In 1935 Knox County had the good fortune to obtain a soil conservation C. C. C. camp. I visited the demonstration area and asked for the assistance of technicians in replanning to prevent erosion. They took out fences, laid out the farm in contour strips, and recommended that the remaining 17 acres be used for permanent pasture. The pasture was treated with 2 tons of limestone and 300 pounds of superphosphate, and in 1938 it carried 2 units of livestock per acre.

"Contour farming has increased our corn yield from 15 to 25 bushels an acre, and the only water and soil loss is in old gullies; even that is caught in the grass strip below. We top-dress our new wheat seeding: With a heavily loaded spreader it is an advantage to follow around the hill, on the contour. We do not combine our small grains—straw is important.

"Rows in our new orchard are on the contour. We planted those trees. Our second son is the orchardist in the family partnership. My wife and I take care of the raspberry patch, along with the garden, and every row is on the contour even though the land doesn't slope much. Some soil on this farm is a little porous and sandy and we save all the water that falls.

"We have a 35-acre woodlot. The barn is the only old building still in use; all others were made from lumber from the woodlot. We take good care of the woodlot and no part of the farm pays any more profit. We purchased an adjoining farm this year which is even more hilly. Already it is all laid out in contour strips. We were reared in the hills and the hills are home. Now that we can watch the contour strips hold the soil and water when it rains we would not leave our hill farm for level land."

1. Using the hay loader to harvest a fine meadow. Little difficulty is encountered by heavy machinery such as hay loader, tractor, and combine on the contoured fields of the Blubaugh farm.

2. Mr. Blubaugh tosses the cap sheaf on a shock of wheat, a crop which fits admirably into the contour pattern of his farm.

3. Cosmos Blubaugh cultivates strawberries. The rows wind gracefully across the slopes. The furrows empty surplus water into well-sodded waterways.

6. The bilities returns

7. The grown vides m element records,

4. No farm plan is complete until the water supply is assured. The scheme devised by the Soil Conservation Service provided this reservoir. The clear, silt-strained water serves many purposes, among them the spraying of orchards and gardens.

5. Mr. and Mrs. Blubaugh are in partnership with their three sons, Augustus, Edward, and Joe. They also trade work with their son-in-law and neighbor, J. L. Finan. Here Mr. Finan is helping spray the Blubaugh raspberries, newly planted on the contour.

6. The garden truck and berries are chief responsibilities of Cosmos and Lucy Blubaugh. Excellent returns are enjoyed from strawberries and blackberries.

7. The Blubaugh wheat seems better now that it is grown on the contour, a style of farming that provides more water for the plants and keeps the food elements in the soil. Blubaugh keeps careful farm records, as reflected by this weighing scene at wheat harvest.

A SOCIOLOGICAL VIEW OF SOIL CONSERVATION

By OTIS DURANT DUNCAN [1]

IN A HALFWAY serious frame of mind a few months ago I made the statement to a group of people who were interested in rural education that it was possible to judge the psychological, physical, social, and economic characteristics of the farm people in a given area by the size of the earthworms found in the particular vicinity. If the earthworms are as large as a new lead pencil and as red as a piece of round steak, the people themselves, it was pointed out, will be robust and happy, optimistic and cheerful, peaceable, economically independent, self-reliant, self-respecting, and not only literate but also well informed on the everyday affairs of both individual and public life. If, however, the earthworms are as small as a match and as pale as the breast meat of an anemic chicken, the opposite will be true. The people will be quarrelsome, suspicious, gloomy, narrow-minded, illiterate, ignorant; sallow and emaciated with big joints and bony cheeks; they will have wide, thin, transparent ears, and their faces will peer out from under shocks of shaggy hair. I did not intend the statement to "take," but several persons actually wrote it down in their notebooks.

No scientific validity can be claimed for such a hypothesis, of course. But it is unquestionable that the better classes of soils will support a more luxuriant growth of both flora and fauna than will thin, poor soil under similar climatic and rainfall conditions. It would be fallacious to attempt to compare the relative fertility, or the capacities of two grades of soil for supporting human populations on the basis of any one organism found in them. However, when all the organisms living in each of two or more different soils are taken together, the results should be at least a rough indicator of their relative fertility. It stands to reason, then, that the same food elements which produce growth in plants and animals are required for human populations. It is apparent, therefore, that under favorable climatic conditions the soils capable of supporting the heaviest growths of flora and fauna are likewise more desirable for the human population than thin, infertile soils.

It must be recognized that other factors besides that of sheer native fertility of soil are important from a social point of view. First, the location of land is a primary consideration. For a human population to survive on land, it must have inlets and outlets, or accessibility to transportation and communication facilities. At the present time, a civilization can scarcely exist under conditions of utter isolation. Also, the value of farm land for human occupancy is enhanced by nearness to markets, schools, churches, health facilities, and governmental agencies such as the courts and the police. Second, the fertility of land must be interpreted relatively. A thin yellow loamy post-oak ridge is better land for producing sorghum for molasses than is black waxy river bottomland, but the latter is far superior to the former for the production of sugarcane. In other words, the fertility of land depends upon its intended use. Third, there are many hazards which, regardless of the land's inherent qualities, render it unsuitable for human occupancy. These are the danger of floods, and the frequency of other natural catastrophies; erodibility as determined by soil texture, slope, and rainfall; the presence of pests such as hookworm and malaria, and other forms of water and soil pollution. The presence of such hazards as these often may offer obstacles to human beings which are more insuperable than the original lack of plant food in the land.

The time has come when it is necessary for us to become cognizant of a very important fact. The ultimate motive for soil conservation is human conservation. Soil is worthless except insofar as it may be made conducive to human welfare. The Indians sold Manhattan Island for $24. To them that was a good price because they did not know how to put the Island to an effective use. It was virtually worthless to them, and by no stretch of the imagination could they have made it more valuable since they determined its value in terms of their own socio-economic system. As a hunting ground Manhattan was probably quite poor, and to give it greater value someone had to put it to a use that would contribute to the welfare of a greater number of people than the handful of primitive Indians who owned it originally. What gave the Island its fabulous increment in value was the socio-economic system which was transplanted to it by the white men.

The great enigma of what we call civilization is that with a few possible exceptions the richest farm lands, the deltas, the alluvial plains, and the costal plains,

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support the poorest populations of the world, whether in the United States, Africa, Asia, or elsewhere. This applies to the lowlands, but not necessarily to uplands like the Corn Belt, the Texas Black Prairie, and a few other sections. Why does this condition exist? It is because the lowlands are conducive to a semi-servile, and sometimes a completely servile, agricultural system. They are infested with malaria and other human pets which drive away all those who can escape, and this leaves behind a class of cultivators who are more or less dependent upon the oversight of their lords and masters and are unable to rise from under this feudal yoke once it has been clamped about their necks. Fertility of soil alone does not guarantee human welfare, but the soil and the social system imposed upon it; and it is far easier to improve the soil than to get rid of a diabolical social practice.

The conservation of soils that are in danger of waste from erosion, together with restoration of the productivity of soils that have been depleted by erosion, over-cropping and bad management, constitute a vital phase of the national welfare. Some precautions are necessary, however, in determining whether or not conservation measures should be used. Much land has become denuded and riddled with gullies until it can be restored only by nature's own processes, that is, for some generations to come it should be abandoned to grow up in wild life again. One of the first questions which must be faced, therefore, is whether or not the expenditure necessary to check the erosion would be wise if made. Will it be a paying investment? Obviously, the circumstances of the particular land in question will have to determine the answer to that question.

A second important question to be answered is whether or not the social situation demands that a particular tract of land be treated to prevent erosion and to restore its fertility. Many facts must be known before this can be determined: In what direction is the movement of population proceeding? What is the trend of natural increase of the population? Are other lands available to which the population can be moved more economically than older lands can be restored? What are the trends with respect to agencies of social betterment such as schools, churches, recreational facilities, health agencies, and the like? What is the situation with reference to transportation, markets, trade centers, and health? Is the location of the land one that, except for worn-out soil, would be a more desirable habitat for human beings than other accessible locations? Can the land support the necessary social institutions if restored to a state approximating its virgin fertility?

A third important question hinges upon land uses that may be employed under the existing climatic conditions. Would shifts in farm organization be preferable to the expenditure which would be required for the soil engineering program? Should farm units be enlarged or made smaller? That is, should the farm operations shift from an extensive to an intensive margin or vice versa? Could soil-restoring and erosion-preventing crops be substituted to advantage for the existing crops? Could cultivation practices be changed? In all these questions one of the main objectives is to find ways of reducing unit costs in production and to lower the fixed costs of the farm operation. There are times when the application of more capital to land will pay dividends, and there are times when it is like pouring soapsuds into a sinkhole in the ground. Where changes in the farming system can be initiated at relatively little expense, if such changes are capable of producing the desired result they should be employed rather than more expensive engineering practices.

The problem is to determine which course may be better suited to the problem at hand. This is preeminently an economic problem at the surface, but in a larger sense its significance is sociological, for it is axiomatic that the productivity of any tract of land is limited. If a disproportionate share of the total product must be absorbed by overhead cost, it can only follow that the standard of living of the people on the land will be endangered.

The best we can hope for in America is that an increasing proportion of our farm people will be forced to reside on poor land. There are several reasons for this. First, mechanization of productive processes in many of the Nation's better farming regions has enlarged farm units and thereby has displaced great numbers of people who must go to poorer areas to find land of any kind. Second, the natural increase of the farm population is still more rapid than is required to maintain itself at a stationary level. The excess population must migrate, either to cities or to the marginal agricultural areas, for the reason that the better lands are occupied already. Migration to the cities is not always possible. Further than that, the cities themselves are overcrowded and are pushing their own excess population toward the land, especially in depression periods, wherever it is possible to do so. Third, the land is wearing out with use, and is being wasted by natural forces, especially in areas that were once thought to be suitable only for clean row-crop cultivation.

In the face of these trends we naturally and justifiably ask, What can be done? There is no single answer to all these problems. In the first place, we live in a changing world, and solutions of all our problems are never found because the forces which produce them never remain constant. It is a hypothesis which is not only contrary to fact but also beyond the pale of human possibility to assume that in a universe as large and complex as ours anything can remain unchanged for even a single moment. Some things change more rapidly than others and with greater moments of force, and all changes produce compensating reactions. The reactions produced are frequently unpredictable. Who knows, for example, that the act of terracing slopes and stopping the flow of water down their little rills may not, in time to come, produce untold problems to people hundreds of miles away and to generations yet unborn? Nobody knows, and for that reason a socially feasible soil-conservation policy must be projected from as long time a perspective as possible.

If, then, the preservation of farm land is to be a continuous process in the future, it follows that it must anticipate our needs from a sociological and an economic point of view. If, as doubtless is the case, we face a problem of increasing scarcity of good land, we shall need to devise ways and means for getting the farm population distributed upon the good land that remains in economically sized and sociologically sized units. Certainly, we do not wish to see the gradual strangulation of the farm family which we as Americans have regarded for so long with a patriotic devotion. If we desire to preserve whatever it is we call an American standard of living for the farm population, the economically productive farm land must not be allowed either to go to waste or to be stealthily taken from under the feet of those who would till it.

This presents another question which is partly a soil-conservation problem. It seems ironical to boast of the wealth of America while hundreds of thousands of farm people, and others, are begging for work, or even a place to pitch their wretched camps. On the other hand there are people who are still sufficiently well fed themselves that they violently oppose the idea of "reducing" American farmers to a subsistence level of agriculture. It is a new interpretation of the word "reduce" to have it mean elevate, augment, swell, inflate, raise, or improve, and that is what would happen to large numbers of farm people if they were reduced to a subsistence level. Many of them have no place to lay their heads. The land they could live on, they cannot get, and the land they could get they cannot live on. It is the moral duty of those agencies which have undertaken the task of introducing soil-conserving practices also to grade and classify land so that those who need homes may find them. A few years ago we felt complacent and secure when we read that in revolution-ridden Russia there were 10 million homeless people, the majority being children. That was horrible. But in this country where we are at peace, both within and without, there is much to be unhappy about. Probably there are not 10 million homeless people in the United States; but if there are no more than 10, there are too many. Our problem is not merely to keep the soil from washing down the Mississippi River, but also to prevent our human resources from going with it. The efforts of soil-conservation agencies must not all be spent on demonstration areas which in their virgin state would hardly have fed a sparrow. Miracles belong to the past, and we must direct our energies at those points at which people can live on the land when and if we are successful in saving it.

When we speak of subsistence, we should be certain that we do not imply only an animal existence for those of whom we speak. What is subsistence? Ordinarily, it seems to be thought of as the minimum number of wants that must be gratified in order to sustain life and ensure the biological reproduction of the species. Men cannot hibernate in order to protect themselves from inclement weather, nor can they blossom in new colors with the approach of spring in order to attract associates and companions. In order to meet these emergencies men have built cultures, but to profit by culture is expensive, and still it is indispensable. It seems, therefore, that a sensible definition of subsistence should imply the ability of a family to sustain itself in a state of physiological adequacy, ensuring health and reproductive capacity, without diminishing the economic, cultural, and spiritual advantages handed down to it by the preceding generation.

If we do not anticipate and demand cultural as well as physiological adequacy it means that a population is not sustaining itself because, for example, after a farm has been used beyond its prime, each succeeding year requires greater ingenuity and resourcefulness and better equipment to maintain even a stationary level of living than did the previous years. In other words, unless there is some advancement provided for, retrogression is absolutely inevitable. Moreover, the social environment grows yearly more complex and difficult of comprehension, which in turn means that the population cannot barely subsist for long in a physical sense without making appreciable advance-

ment culturally, at least in a competitive society with open social classes and free individual enterprise.

In conclusion, let it be said that the soil upon which a man lives is one of the most important determinants of the soul that lives within him. Whatever may be the steps necessary for the farmer to take in order to conserve his soil resources, in time he will be compelled either to adopt them or to perish. His will to live is powerful enough to force him to exert the required effort. Increasingly, farmers along with other people are forming a larger conception of the meaning of life in its fullest sense. In order that a full realization of this new concept of life may be effectuated, men are becoming aware that the resources they possess must be used effectively and with the highest possible degree of mechanical efficiency. The efficiency of men, like that of machines, can be measured only in terms of the number of energy units consumed in accomplishing a given amount of useful work. In the farm-management sense, this idea may be expressed as the ratio of the input factors to the output. In a sociological sense, it is more difficult to define because the units are comparatively intangible, but even here it represents the relation between the social energy which must be expended in bringing a group to a given degree of advancement and the resulting cultural accumulation at a point of advancement. In other words, efficiency is the relation between effort exerted and the positive gain accomplished. But, energy is limited and possible achievement is limited. The only way, therefore, in which man can rise on the scale of advancement is by learning how to consume a smaller quantity of energy in attaining a given stage of advancement. Then as men enlarge their spheres of living they must utilize their resources more effectively.

Enlightened self-interest directed by intelligent technical guidance is our greatest assurance that the farmer will gladly lend his assistance in the direction of con serving his soil. All farmers worth mentioning are anxious to spare themselves toil and labor. They are desirous of leisure and opportunity for cultivating their own personal ambitions. They have learned that in their enlarged spheres of living they have acquired new and greater responsibility. They have become aware of their obligations to their grandchildren as well as to their own children. The time was and is no more when every farmer could give his sons homesteads of virgin land when they reached maturity. The family farm is all the land there is now, and only a minority of the farmers have that. The farmer recognizes this as well as anyone, but he is no less anxious than was his own father to give his children the opportunities which in his own estimation they deserve. To do that he rightly feels that he must save his soil which is his chief source of wealth and his prospect for security.

We ask ourselves frequently what goal or criterion may be set up by which we may judge the efforts now being made to save our farm lands. Experts do not agree on the answer to this. However, an inescapable conclusion is that soil-conserving practices should be motivated by two positive objectives: (1) The maintenance of the present farm population in a state of physiological and cultural adequacy, that is providing all the necessities for physical and mental health, and at the same time affording the advantages of education, recreation, and social participation and (2), the preservation of the productive powers of the land itself so that it may be passed on to future generations without deterioration.

Some thinkers and investigators contend that the interests of the individual farmer come into conflict with those of society as a whole on the question of preserving the land for future generations. Such an argument is irrelevant, incompetent, and inconsequential. Does not the very life of the farmer demand that he tithe himself to save his land? Is it in the interest of the farmer that he exploit his land, himself, and his children, in order to turn the proceeds into cash? The cash he can not eat, wear, or take with him when he dies. Is not the individual farmer a part of society in the broader sense? Probably that may be one of the difficulties by which he has been bedeviled for centuries. Even the prospect of an old age spent in helplessness should be sufficient incentive to cause the farmer to desire to conserve his soil so that when he can no longer work for himself he may have a competence by which his independence may be guaranteed.

When all that pertains to soil conservation is said and done, one fact will remain: That the soil is indispensable not merely to the farmer but to everyone else as well. A source of trouble in the past and a danger in the future is that too often the land is thought of as an end in itself rather than a means toward greater ends. We have bought land on which to raise corn with which to feed more hogs with which to buy more land. In all this we have followed the line of least resistance and depended for counsel upon the primitive tradition that he who owned land had something which none could take from him. Little did it matter that we stole it from ourselves

(Continued on p. 284)

COUNTY PLANNING SUMMARY

By D. A. FITZGERALD [1]

FARMERS have accepted the opportunity afforded by the county land-use planning program to participate with technicians and administrators in the democratic development of agricultural plans, policies, and programs through organized community, county, and State planning committees. In the first 12 months after the program was initiated jointly by the Department of Agriculture and land-grant colleges, it reached 1,120 counties in 47 States. Nearly 70,000 farm men and women are cooperating as members of organized county and community planning committees.

Memoranda of understanding between the Bureau of Agricultural Economics and the State agricultural extension services and experiment stations, covering the features of the planning organization and the general types of cooperative work, have been signed in 45 States. All these States have established State land-use planning committees or advisory councils except Tennessee and Kentucky. Additionally, in Illinois, an informal State committee has been organized, although the land-grant college has not yet signed the memorandum of understanding. California and Pennsylvania are the other States that have not yet entered into formal arrangements with the Bureau. In Illinois and California, many of the land-use planning activities proposed by the Department are being performed.

State land-use planning committees vary in both size and composition, depending upon the number of State organizations represented and the number of type-of-farming areas in the State. Arizona, with 12 members, has the smallest committee; New York, the largest, has 48 members. On the 43 State committees now organized, 552 farmers are serving. This is an average of 13 farmers to the committee.

Four Department agencies and two State agencies—the Farm Security Administration, Agricultural Adjustment Administration, Soil Conservation Service, and Bureau of Agricultural Economics, State extension services and experiment stations—are represented on each of the State land-use planning committees. The Public Roads Administration is represented on 39 committees, the Forest Service on 38, the Farm Credit Administration on 14, and the Bureau of Biological Survey on 13. The Extension Service and experiment stations are represented on all State committees. State planning boards and State highway departments are represented on 21 committees each.

Most of the committees have a membership of from 22 to 30 persons. Farmers constitute a majority of the membership of 17 State committees. In 35 States, farmers are the predominant single group. Representatives of the Department of Agriculture outnumber the farmers in 4 States.

About 19,000 farmers are members of organized county planning committees, and nearly 51,000 are serving on 6,807 organized community committees. Farmers predominate in the membership of county committees, with representatives of the Department representing the next largest group in most counties. Community committees almost without exception are made up solely of farm men and women.

Besides the 1,120 counties with county land-use planning committees, there are 75 counties in which planning activities are being conducted by community committees prior to formal organization of county planning committees. Besides, a number of counties have set up county committees, but have not progressed to the stage of establishing formal community committees.

In many instances, farmer members of county and community land-use planning committees are also members of farm security advisory committees, agricultural conservation program committees, production credit committees, and many others. It is estimated that about 200,000 farmers, in addition to members of county or community planning committees, took part in land-use planning meetings held during the 6 months ending December 31, 1939.

The number of meetings held by individual county and community planning committees during the same

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6 months varied from one to nine, depending on the stage of the planning work. Some county committees have set up executive and subject-matter subcommittees to give intensive attention to specific phases of the county planning committee's work.

During the fiscal year 1939–40, 1,195 counties were selected for planning. Of these, 388 were designated as "preparatory," 761 as "intensive," and 46 as "unified," to use the vocabulary of the county planning project.

Of the 765 counties chosen for intensive planning at the start of the fiscal year, 566 actually carried on area mapping and classification work prior to January 1, 1940. In 47 of the selected counties, work has not advanced beyond the study of basic information and in 152 others intensive work has not begun. In 225 counties the county and community committees have already finished their area classification maps. In 112 counties the work has progressed to the point where a preliminary draft of the area mapping and classification report is being reviewed by the State land-use planning committee. County reports covering the results of area mapping and classification for 59 counties have been reviewed by the State land-use planning committees and submitted to the Department. These reports are being analyzed and summarized.

To date, 43 of the 46 unified counties have made appreciable progress. Formal progress reports from Wyoming County, N. Y.; Ross County, Ohio; Lewis County, W. Va.; Chittenden County, Vt.; Coos County, Oreg.; Allegany County, Md.; Lee County, Ala.; Caswell County, N. C.; and Culpeper County, Va., including agreements by action agencies to initiate recommendations of the land-use planning committees and statements of action that have been started, have been studied and approved by the Inter-Bureau Coordinating Committee. Committees in about a dozen more counties have submitted either preliminary or final reports proposing unified county programs. These will be ready for presentation to the Inter-Bureau Coordinating Committee in the near future. The other counties are still in the process of preparing plans.

Some 738 recorded instances of results growing out of the land-use planning program during the last 6 months have reached the Department of Agriculture. They occurred in 445 counties in 38 States. These results have been in the nature of conserving natural resources, improvement of rural living conditions, action on school costs and organization, counsel on State and local legislative and administrative policy, adaptation of action programs to local conditions, measures to facilitate coordination of agricultural programs, achievements through cooperative undertakings, and orientation of educational programs.

Land-use planning was not, of course, solely responsible for all of them. In some instances, steps toward solutions probably would have been initiated without it; in others, land-use planning merely provided the additional stimulus needed to obtain results; but in many, the committees identified problems, proposed remedial measures, and sponsored the corrective action.

As examples of the first type of results—conserving natural resources—planning committees assisted in the organization of soil conservation districts in Yell County, Ark.; De Baca County, N. Mex.; Tillamook County, Oreg.; Box Elder County, Utah; Elbert County, Colo.; and Culpeper County, Va. In Quay County, N. Mex., and Marshall County, S. Dak., the boundaries of existing districts were extended.

The part played by the land-use planning committees in sponsoring soil conservation districts has varied from place to place, but in all these counties the committees have studied the erosion problem and recommended that districts be set up. In addition, the committees often have arranged public educational meetings, and committee members have circulated petitions to get the required number of signatures. How well these methods have worked is shown in Box Elder County, Utah, where earlier efforts to form a district had failed.

In a number of counties, the Soil Conservation Service has used the planning reports in drawing up district programs and work plans, and in other instances the planning committees themselves have given advice and aid in drawing up such district programs and plans of work.

In Kootenai County, Idaho, most of the best farm land is owned by Indians but farmed by white people. Erosion, noxious weeds, and depletion of fertility have caused serious problems. As a result of the efforts of the planning committee, the Soil Conservation Service is preparing conservation plans for these farms, and the Office of Indian Affairs has agreed to include these plans in the leases. In Newberry County, S. C., the committee proposed that land along streams be developed as permanent pasture. The Forest Service has agreed to develop its holdings in these areas for this purpose, while the Soil Conservation Service plans to use C. C. C. labor to clear such land. In the same county, the Farm Security Administration, the Soil Conservation Service and Extension Service have decided to give more attention to winter cover crops in their farm plans.

Erosion-Control Lessons From Old-World Experience

VI. FIELD BOUNDARIES IN RURAL ENGLAND

By W. C. LOWDERMILK [1]

DURING a whirlwind period of occupation of a new continent we of the United States have been prodigally wasteful of what at first appeared to be inexhaustible resources of forests, game, and soils. We have pushed the frontiers of new lands westward, ever westward, to the Pacific Ocean. The land is occupied, free lands are gone forever. There are no more new continents to discover and occupy. Rather must we find another frontier in the conservation of our lands under use; such a frontier offers a zest for exploration and achievement no less enthralling and profitable than the wild lands of early frontier days. For upon the realization by each generation of the necessity to safeguard lands and waters does the future well-being of our children's children and our Nation depend. The laws of inheritance in the United States do not provide for primogeniture as in England. We do not have this incentive to take pride in, and to improve an estate during the lifetime of its "owner." Its equivalent is needed; for we must find a way of imposing and accepting the same responsibility for maintaining our lands in a state of sustained productivity from generation to generation.

May we, too, realize that our fences, our barns, our homes, our soils, and our waters are not a possession for our individual exploitation, to use, abuse or destroy at will, but a sacred trust as our link in the chain of generations which connect the past with the present and the future.

Rural England, after centuries of agriculture, is an intimate landscape; it is not wild and untamed as is much of the countryside in the United States. It bears the marks of a land, fashioned and cared for by men's hands, mellowed with time, and now ripened in benevolent maturity.

The field boundaries of rural England seem to be permanent, for they were established so many centuries ago; some are known to date as far back as Roman times. Certainly there has been little change in centuries. One may examine a map, made four centuries ago, of the lands of the Rothamsted Experiment Station in east-central England. When a recent survey map is placed over this old map it is seen that field boundaries have, for the most part, remained identical, although the fields have changed owners from generation to generation.

These ancient field boundaries may be of mossy brick or stone masonry, dripping with dampness and plumed with ferns. Others may be made of countless small pieces of flint or stone, laboriously dissected from the soil through centuries of cultivation, neatly piled, row upon row, and made into miniature Walls of China. These walls meander through valleys and scramble tens of thousands of miles, over hill and dale, representing labor over centuries of time. In countrysides where stone and brick are lacking, other sorts of field boundaries dominate the landscape. In southern and central England luxuriant hedges of beech, hawthorn, English holly, and hazel bush intertwined with bramble or ivy, outline each irregular field, and shelter homes and nests for the birds of the air. These hedges are trimmed tidily, giving the countryside a well-groomed appearance. The huge gnarled vines, moreover, betray their long existence through the centuries. The stem of an ivy vine may be 15 inches in diameter. One often wonders what long-obliterated obstacle caused a boundary to curve or bend, twist or circle. Perhaps it was a big rock, or a huge tree which later was builded into a manor house or a shire church. Though the obstacle has gone long since, the bend of the field boundary remains unchanged.

These hedges have endured so many centuries that some are standing on elevated earthen ridges, several inches to several feet in height, where the earth has been held in place by a mass of roots. The levels of enclosed fields may be inches or feet below the former level of the ground as marked by elevated roots and earthen ridges surrounding the fields. This removal of soil by erosion and shifting by plowing took place so gradually over so long a time that new soil was formed as rapidly as it was worn away—for the fields are still fertile and productive.

Field boundaries have proved to be a social necessity. They represent the agreements between conflicting interests. Strife over the boundaries of fields in England must have come to an end long ago, since the size and shapes of fields have endured century after century as marked by ancient and unmistakable borders. This is an achievement of far-reaching importance. Today enduring boundaries between fields and

[1] Assistant chief, Soil Conservation Service, Washington, D. C.

Rural England has aged. Field boundaries, centuries old and winding about, have become bearded with grasses or covered with vines. An English rural scene is never without picturesque trees scattered about over the landscape.

between nations are symbols of peaceful cooperation between individuals and peoples.

More than this, the picturesque field boundaries of England have saved the soils from wastage by erosion. The land is broken into small fields, and runaway waters are stopped or checked at field boundaries of walls and hedges. The wild storm waters do not gather into raging torrents to cut gashes or gullies into the fields to carry away the soil. Wherever the field boundaries lie across the slopes, the fields are benched behind them. The flattened field further safeguards the land against erosion wastage of the soil. Stabilized soils conserve fertilizers and works of soil improvement; they assure a permanency of agriculture which is the pledge of charming hedges and moss-covered walls that border the fields.

It is fitting, in a land where agriculture and land use have been so long subdivided by field boundaries, that England can boast of the oldest agricultural experiment station in the world. For more than 90 years records have been kept on the Broad Balk field plots, showing the comparative treatment of the land and its corresponding responses. It is one of many experiments in land use, to discover how the soil may best be treated with fertilizers and rotations for a sustained production of crops. To this agricultural experiment station, at Harpendon, have come students and scientists from all nations, to seek the agricultural wisdom accumulated in the archives and varied experiments of this institution.

If a nation is to endure into the unknown future, it must provide a permanent agriculture for its people, for the sake of the present and for the future. The land, with its soil and water resources, is one of the most vital and direct links we have with the future, beside our social institutions and blood relationships. If, in this chain, from generation to generation, the lands and waters are held in sacred stewardship, to use, to safeguard, and to improve, and afterwards to pass on in a state of sustained productivity to the future, our civilization may endure and prosper. If, on the other hand, one or more generations prove unfaithful trustees of the land and allow field boundaries to crumble, terraces to break down, soils to wash from the hillsides, and gullies to gouge out the fertile slopes and valleys, and to waste the water resources, they bring a curse of want upon the land. All who seek to work out a living on such despoiled lands are heavy laden with burdens of poverty and lower standards of living, and a population becomes more subject to political and social decadence. An enduring agriculture is the basis of a lasting civilization.

The wastage and loss of the natural resources of the earth, due to the ignorance, negligence, willful destruction, oppression, or carelessness of man, are staggering and beyond all human conception. With increasing populations throughout the world, and with all lands now occupied, the realization that man is continuing to destroy the food capacity of the earth for future generations must arouse thinking people to a new conception of man's relation to the earth. When a nation builds for centuries toward a permanent agriculture as England has done, who can limit

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MICHIGAN DISTRICT'S LETTER BALLOT

By F. E. CHARLES [1]

ONE of the admirable features of soil conservation districts is that they are organized by land owners and managed by supervisors elected by residents. Framing of the district work program offers one of the first opportunities for the people to express themselves on operation of the district.

To make sure that residents of the district had a part in forming their work program, supervisors of the Fenton, Mich., district employed a unique idea. They gave to landowners this brief "letter ballot":

The following is designed to determine what you think are important problems or activities that you and your community are or should be concerned with, or whether they could be used in your township for the betterment of the township. By placing check mark in front of items listed below that you feel are most important, you will enable us (the Directors of the Fenton Soil Conservation District) to get a summary of problems or activities that should receive special emphasis in our program. If there are other activities or problems that we have not listed, we would be pleased to have you write them in the spaces provided at the end of the list.

[1] Chief, regional division of information, Ohio Valley Region, Soil Conservation Service, Dayton, Ohio.

This introduction was followed by a list of 42 methods, practices, and services, arranged in ballot form, so that the landowner might express easily his interest and so that his suggestions could be considered for inclusion in the district work program. A place for the landowner to write his name and address completed the letter.

The Fenton district supervisors believe that this is a good method of obtaining widespread expression on the details of district operation. It is proving efficacious also in arousing interest in the work of the district, getting every landowner to thinking of the problems, and in giving everyone an opportunity to state his opinions. J. H. Skinner, employed in 1912 as Michigan's first county agricultural agent but now a farmer, originated the letter ballot for the Fenton district supervisors. The district, fourth to be established in Michigan, embraces parts of Livingston and Genesee Counties and includes a portion of the Fenton soil conservation demonstration area.

CONSERVING KEY AREAS IN SOUTHWESTERN RANGE LANDS

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with alfalfa. It is planned that, as rotations come into practice, several hundred acres will be in cereal crops each year. Also, about fifty acres of overflow lands having relatively poor drainage will be seeded to Reed's canary grass.

Considerable clearing of brush land has been done by the Indian Service. A bulldozer attachment was used for this work and this implement, in addition to removing the brush, also tills the land and thereby facilitates follow-up leveling for irrigation. A heavy brush railer, designed by the Indian Service with the assistance of the Soil Conservation Service technicians, cuts a 12-foot path and windrows the brush behind it. One man operating the tractor and railer can remove and windrow 15 to 20 acres of sagebrush a day. On moderate slopes, with limited irrigation facilities, the brush will be windrowed on the contour and used as protective buffers for new seedings. On other areas the cut brush will be scattered over the seeded areas as demonstrations of mulching for erosion prevention, for seedling protection and moisture conservation. According to present plans, several hundred acres of sage-covered bench lands will be cleared in this manner so that the land can be used for pasture or hay.

Grasses and legumes specified for pasture and hay are yellow sweetclover (*Melilotus officinalis*), western wheatgrass (*Agropyron smithii*), crested wheat (*Agropyron cristatum*), and giant wild rye (*Elymus condensatus*). On the more favorable sites, smooth brome (*Bromus inermis*), and mountain brome (*Bromus marginatus*) will be used in mixture with the above named species. Coincident with the seeding program, proper management practices will become effective.

The Duck Valley Indian Reservation is an example of numerous similar "key spots" that are to be found throughout the range country in the Pacific Southwest. The welfare of the people and of the land in these communities determines, to a large degree, the usefulness of the millions of acres of grazing land that surround them Meadow pasture values cannot be readily computed in dollars and cents when there are hungry animals and no hay stacks, and when Nevada lives up to its name as a snow-covered highland. By applying conservation principles to these "key spots," increased forage production can be expected and the tendency toward over-utilization of the range can be relieved without necessarily diminishing the number of livestock.

PRICE RIVER DISTRICT AND THE SUBMARGINAL LAND PROBLEM

By R. G. HOWARD [1]

A NEW idea for forestalling fruitless attempts to develop submarginal farms has been put to work in Carbon County, Utah. The plan is based on an agreement between the county commissioners and the Price River soil conservation district whereby the commissioners will sell county lands only after they have been carefully inspected and land-use capabilities determined. This makes it possible for both the county authorities and prospective purchasers to know what may ordinarily be expected of a piece of land on a long-time production basis.

Carbon County, as the name suggests, is highly productive of coal. Surface usage of timber, grazing, and irrigation farming are considered minor industries. In the depression years, around 1933, 75 percent of the privately owned farm land was forfeited to the county because of delinquent taxes. Since then many of the better lands have been redeemed, mostly by their former owners, but a large acreage is still held by the county. Some can be used profitably but the remainder never can be made into productive farm land.

The farming communities are located in areas of highly dispersed soils which erode rapidly at the slightest cause and are underlain by the Mancos shale beds at depths of a few inches to several feet. The shale is so highly impregnated with soluble salts that irrigations, where the shale beds lie close to the surface, quickly saturate with alkali both the shallow soils and any adjacent soils receiving that water as subsurface drainage.

Modernization in the mines through use of labor-saving machinery has caused a steady decrease in employment, and the miners, to whom the change in labor needs is constantly evident, are buying farms and moving to them. These underground workers usually think of the farms as double securities—homes from which they cannot be moved because of industrial inactivity, and productive outlets for labor during lay-off periods. Most of them have little knowledge of the requirements necessary to a profitable farm unit and they are often deceived by soil surface appearances. The result is that scores of miners have moved to farms that are submarginal in every sense of the word.

For the most part these farms have been purchased from the county because the land could be obtained more cheaply there than elsewhere. Purchases are made on a sale-contract basis with a small down payment and the balance prorated over a 2- or 3-year period. As an added incentive, no taxes are assessed until the contract is completed and title actually passed.

To the bona fide farmers and agricultural agencies, the consequences of this movement to "unfit lands" was very apparent and became the subject of comment in various farm group meetings. In an effort to work out a solution, the county extension agent, the Farm Security Administration supervisor, and the district conservationist of the Soil Conservation Service called a joint meeting of the county agricultural planning committee, the farm-debt adjustment committee and the Price River soil conservation district supervisors. At the meeting the facts of the problem were reviewed and suggestions were requested. Those attending the meeting included 13 of the key farmers and businessmen of the community.

Discussion revealed the fact that the Price River soil conservation district already had a memorandum of understanding with Carbon County providing for proper land use on county-owned lands, and that some technical help was available to the district through its memorandum of understanding with the Department of Agriculture. Accordingly it was unanimously decided that with these facilities as a foundation, remedial measures could best be carried forward by an amendment to the existent agreement between the district and the county.

These businessmen and farmers met with the county commissioners, reviewed the problem to them and explained its seriousness, and proposed that all applications for purchase of county-owned lands be referred to the district supervisors. Under such a plan it would be the duty of the Price River district to have a physical survey made of the lands applied for—the surveys to be turned over to an investigating committee of three representing the above-named farm groups. This committee of three would, in turn, review the physical survey data and, if necessary, actually go over the land to determine its potential utilization. They would then make a report of findings to the county commissioners. Finally, the commissioners would require as a consideration of sale that the land be used only to the extent of its capabilities as

[1] District conservationist, Fremont-Price area, Southwest Region, Soil Conservation Service, Price, Utah.

determined by the committee in its report, and that the land be placed under cooperative agreement between the purchaser and the soil conservation district.

After all phases of the proposal were carefully considered, an amendment calling for these provisions was prepared and signed. There was one exception, however, to the original recommendations: As a result of a legal opinion, the requirement for cooperative agreement was applied only to those lands where the prospective buyer offered a price less than the total tax obligation. The commissioners were confident that this would include 97 percent of the purchase applications.

In the first three weeks 20 different plots of land totaling 3,600 acres, on which more than 30 applications were filed, were referred to the district. Reports on 15 of these plots have been returned to the county commission. The committee, at its own request, does not know the names of applicants as they wish to form an unbiased opinion and to prevent situations which might result in criticism.

The committee's report on each piece of land consists of four parts as outlined below:

A. Physical survey map, colored to show land-use classes according to their capabilities.

B. Simple key from which the layman can interpret the physical survey data.

C. Copy of the general standards and capabilities of the various land classes.

D. Data sheet, giving the following information:

1. Number of acres.
2. Location of the land in reference to existent landmarks.
3. Amount of arable land by classes which can be irrigated.
4. Amount and location of alkali.
5. Amount and condition of fences.
6. Number and condition of other improvements.
7. Opinion of the investigating committee as to whether or not the farm can be made an economic unit.
8. Any additional comments by the committee. Such comment may be, in effect, that the land could be used by an adjacent operator but not as an economic unit in itself; or that the land could be used for grazing purposes in connection with an already established farm or range unit, but should not be sold to an outsider who could use it merely as a place to locate stock which would immediately trespass on established units.

The county authorities have long recognized that they were faced with two serious problems: First, that if the lands were to be permanently productive in tax payments, proper land use must be observed; and second, that misrepresentations by applicants frequently caused them to take less for land than they felt was justified after seeing its value in terms of production.

These authorities have expressed themselves as feeling that the data being furnished will aid them in solving both of these problems. The farm committees who were responsible for initiating the program are certain that it is a step forward in the development of a progressive and permanent farming community.

FIELD BOUNDARIES IN ENGLAND

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the life of that civilization? Today, after two and three thousand years of agriculture, fields are still highly productive; soils are protected from erosion wastage, and farms and equipment are maintained in orderliness for the future.

Field boundaries mark the limits of rights and type of land use; they set apart, as well, the areas of responsibilities. They avoid conflicting uses of land within an estate and within a nation. Over a multiplicity of division spreads a unity of purpose in a complexity of use. As the needs of man are various so is his use of the land. His requirements unify and coordinate the uses of land, as in selection and distribution of crops for fields and pastures. Varied uses of land are in time suited to the field in response to the requirements of a people and limitations of climate and erosion.

A SOCIOLOGICAL VIEW

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through carelessness and wasteful extravagance. Shall we see the time when bread made of wheat grown on our own land will be too dear for our children to eat? Little do we think so now, but little do we realize that the Balkan peasant once may have felt as we do. He had white bread, but now he must eat the black. It will be a sorry day for America when the farmers of this country become too poor to eat and to enjoy what they have produced by their own labor. Let it not come upon us.

IMPORTANCE OF SNOW SURVEYS

Snow surveys are designed to determine in advance what the water supply will be for the coming growing season. Irrigation farmers, power companies, cities, and other water users are notified of the results in order that the supply of water can be wisely rationed during summer months.

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